Fundamental Science on NIF- the Path Forward

NIF/Jupiter User Group Meeting

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NIF

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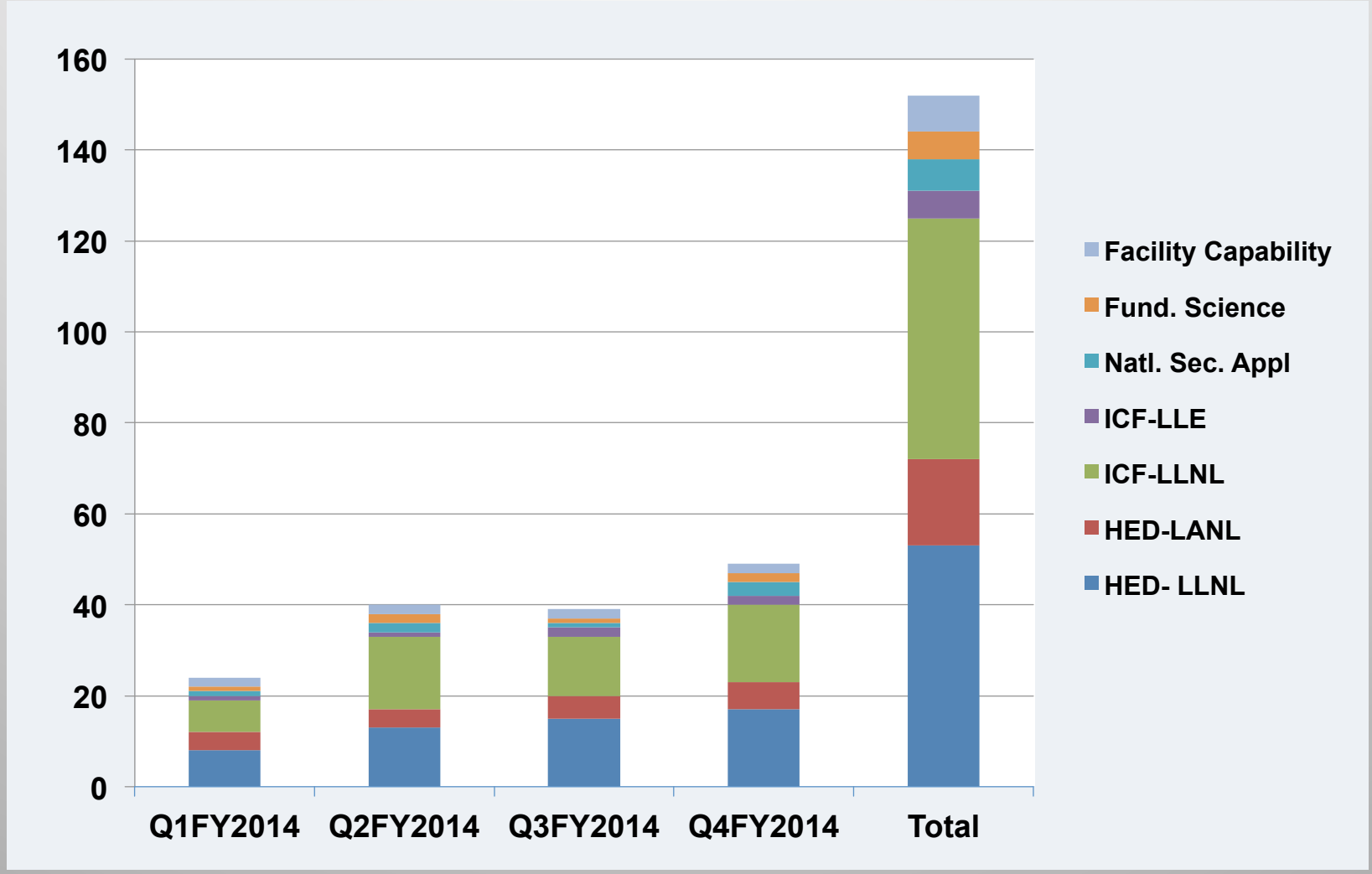
NIF shot totals for FY2013

Category	Shots
SSP-Ignition	72
SSP-HED	86
Fundamental Science	7
Natl. Security Applications	4
Diagnostic Development	40
Subtotal- target shots	209
Facility Calibration	128
Total	337

Augmenting shot rate for all communities is a clear NIF priority

FY2014 NIF Use Plan submitted to NNSA HQ includes approximately 150 target shots

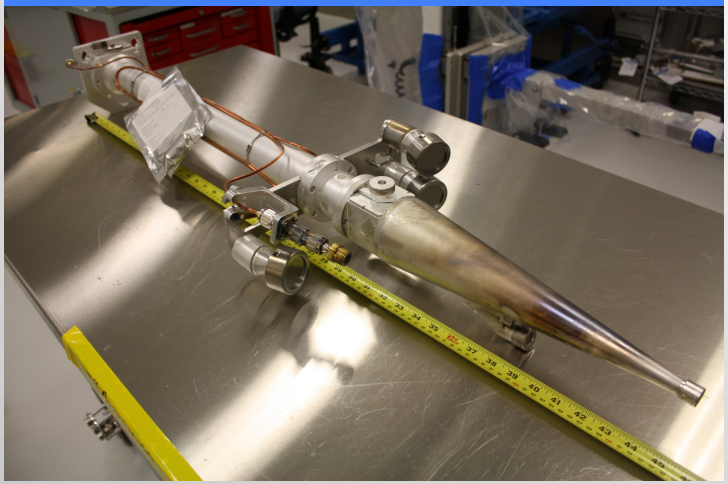


NIF fundamental science experiments

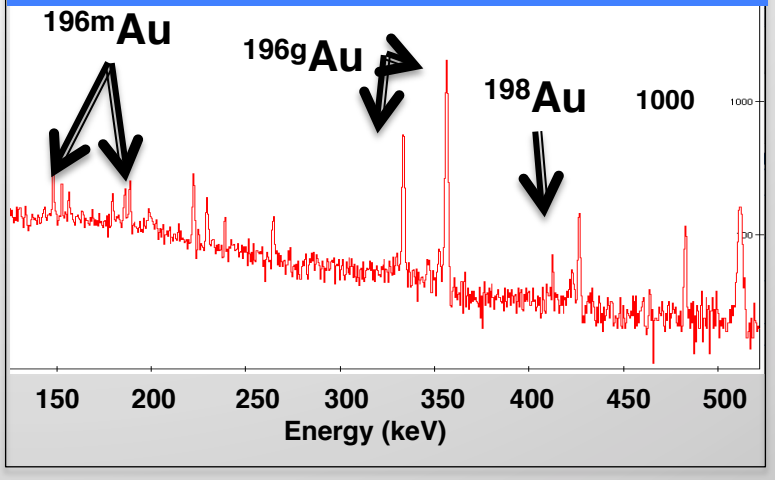
Topic	PI Last	PI Institution	FY13	FY14
Carbon and Iron Equation of State	T. Duffy/ R. Jeanloz	Princeton/UCB	2	
Supernova hydrodynamics-Radiative Effects (Rad SNRT)	C. Kuranz	Univ. of Michigan		
Novel phases of compressed diamond	J. Wark/ J. Eggert	Oxford/LLNL	1	-
Nucleosynthesis and the s-process	L. Bernstein	LLNL	Complete	Complete
Rayleigh-Taylor instability and astrophysical implications (merged proposal)	A. Casner/ V. Smalyuk	CEA	1	3
	J. Kane	LLNL		
Matter at ultra-high densities (merged proposal)	P. Neumayer	GSI	3	2
	R.Falcone	UC Berkeley		
Hydrogen and methane at ultra-high pressures (merged proposal)	R. Jeanloz	UC Berkeley		
	R. Hemley	Carnegie Institution of Washington		
Diverging Supernova hydrodynamics	T. Plewa	FSU		
Astrophysical collisionless shocks (merged proposal)	Y. Sakawa	Osaka University		1
	G. Gregori	Univ. of Oxford		
Relativistic pair plasmas	H. Chen	LLNL		

Production of low energy neutrons in ICF implosions is important for determination of nuclear cross sections of interest to astrophysics, and diagnosis of ρR_{fuel} for ICF experiments

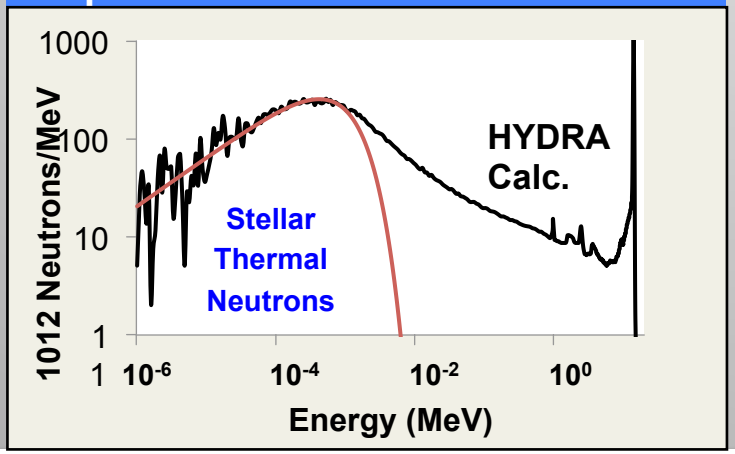
Four collectors mounted on a DIM



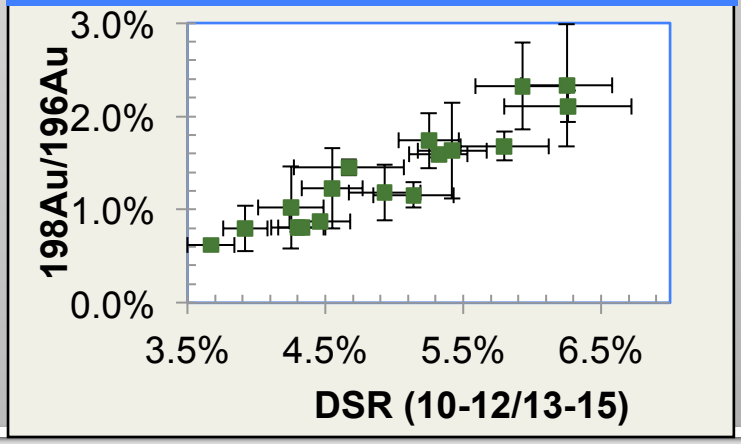
γ-decay is counted in B151- ^{198}Au produced by downscattered neutrons



Inferred low-energy neutron spectrum similar to that of stars



^{198}Au/^{196}Au is also a ρR_{fuel} diagnostic



Path forward- fundamental science on NIF

- NIF is transitioning to new operational mode
  - Allocation of time vs. shots
  - “Mini-campaigns”- facility held in fixed configuration
  - 9 shots (7 target shots) executed the week of 2/3/14 show promise of this approach
- The NIF Science Technical Review Committee (TRC) will review a proposed new solicitation on April 8-9, 2014
  - Will allocate time on facility rather than shots
  - NIF needs to provide tools (optics use, etc.) to enable potential users to estimate time required for proposed experiments
- Following the TRC review, a new solicitation will be issued
- As discussed at last user meeting, awards will be in 3 categories:

  a) “Ready to shoot:” Proposals awarded time on facility schedule

  b) “Further development required:” Strong scientific proposal that requires additional interaction with NIF staff to develop an executable experiment

  c) Proposal rejected- insufficient scientific merit
- Plan is to solicit experiments every 12-18 months, with progress for each group reviewed at each NIF Science TRC meeting (“incremental” awards)

We request your input on this solicitation and shot review/execution process

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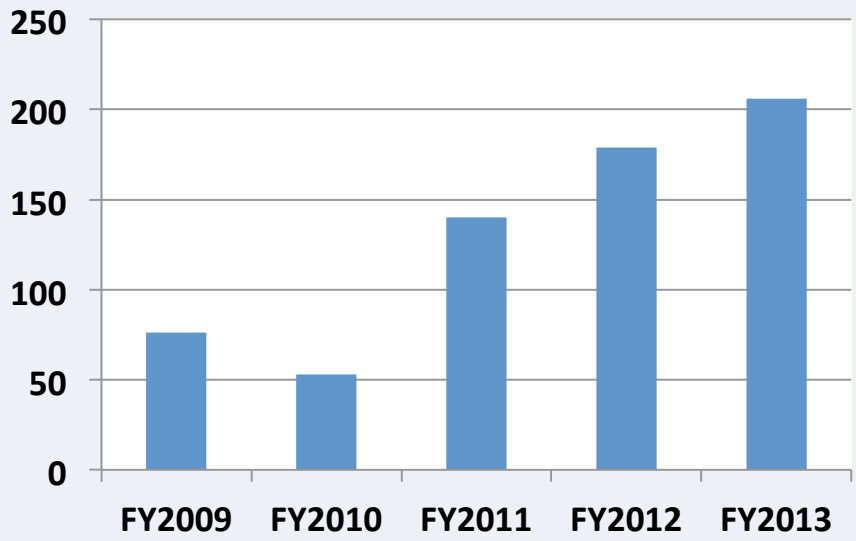
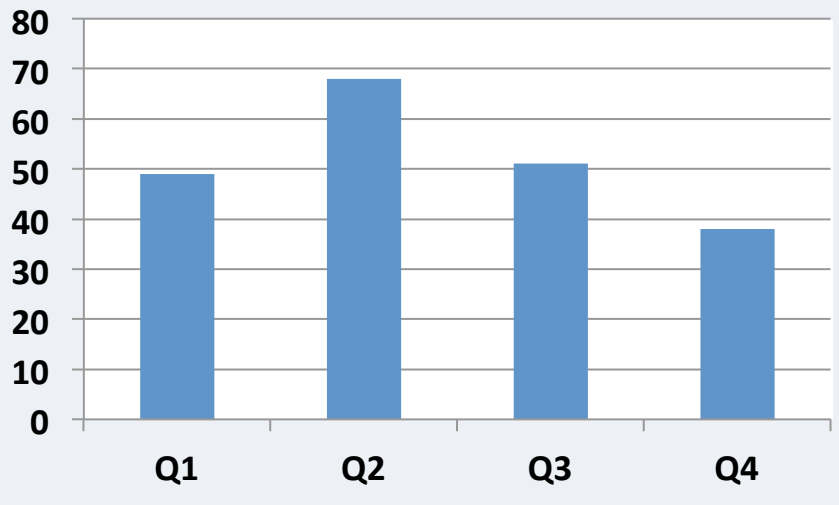
NIF shot rate increased through Q2FY2013- "rollover" in shot rate is due to staff reduction in response to sequester and transition to reduced FY2014 funding

NIF target shots by fiscal year



FY2013 NIF target shots by quarter



Summary of new capabilities currently planned

Capability	Shorthand	Status	Due Date	Type
Gaseous radiochemistry diagnostic	RAGS	Approved	January '14	Diagnostic
M-band spectrometer coupled with Dante	Virgil	Approved	July '14	Diagnostic
Beryllium	Be Targets	Approved	July '14	Infrastructure
NIF X-ray Spectrometer (DTRA)	NXS	Approved	August '14	Diagnostic
High temporal resolution x-ray imager	DIXI	Approved	August '14	Diagnostic
High Z material capability	HighZ	Approved	January '15	Infrastructure
Magnetic Proton Time-of-Flight (MIT/LLE)	mPTOF	Approved	February '15	Diagnostic
Kirkpatrick-Baez x-ray optic	KB-1	Approved	February '15	Diagnostic
ARC commissioning - first four sub-apertures	2 Beams ARC	Approved	March '15	Diagnostic
Automatic long-delay backlighter	Auto LDBL	Approved	March '15	Diagnostic
ARC X-ray Imager	AXIS	Approved	March '15	Diagnostic

Summary of proposed new capability projects

Priority	Type	Capability	Shorthand	Status
1	Diagnostic	Upgrade to KB optic	KB-2	Proposed
1	Diagnostic	Another equatorial DIM near 90,315	DIM 5	Proposed
1	Diagnostic	nPOLE nToF	NTOF NP	Proposed
1	Diagnostic	DIXI/SLOS in a TIM	SLOS	Proposed
1	Diagnostic	4 frame CMOS for LEH time (w SNL) - or alternate approach.	LEH-t	Proposed
1	Diagnostic	Start Thomson Scattering	TS	Proposed
2	Diagnostic	Neutron temporal diagnostic	NTD	Proposed
2	Diagnostic	Gamma Spectroscopy	Super GCD	OMEGA test
1	Infrastructure	Classified electronic data on PDIM	Classified PDIM	Proposed
1	Laser	2-lambda front end for CBET control	2-lambda	Proposed
1	Laser	Polar Direct Drive Phase Plates	PDD Phaseplates	Proposed
1	Shot-rate	AMP for GDSs	AMP GDS	Proposed
1	Shot-rate	Vacuum pump upgrade to enable TARPOS/CTS interleaving	TARPOS Cryo	Proposed
1	Shot-rate	Upgrade diagnostic exchange equipment and process	DHU Carts	Proposed
1	Shot-rate	Tracker-based alignment system for inside the TC	ATLAS	Proposed
2	Diagnostic	Start high res xray spectrometer	HiRes	Proposed
2	Diagnostic	X-ray imaging registration to n image (LANL)		Proposed
2	Infrastructure	DT on TARPOS		Proposed
2	Shot-rate	X-ray source for offline flat-field and timing	Flat-field	Proposed
2	Shot-rate	Target LRU		Proposed
2	Shot-rate	NIS/VISAR fast-swap capability	NIS/VISAR	Proposed

We request NIF User Group input on this list

The NIF 120-day study is looking at improving the NIF shot rate

- Draft Senate language asked for NNSA to develop a plan to improve the NIF shot rate over 3 years, consistent with FY2014 funding
- NIF Director (J. Atherton) and Deputy for NIF (D. Larson) co-chaired the effort, with initial input due to NNSA by mid-February
- Another important goal is to provide insight into the NIF planning basis and to benchmark NIF with Omega and other large, complex facilities
- Four subgroups (experiments, operations, targets, integration) include experienced personnel from numerous institutions

120 Day Study report will have three major recommendations to increase the data output from the NIF

- Increase the facility time devoted to shot operations
  - Increased use of day shift for shot operations
  - Consolidate maintenance work
  - More efficient commissioning of new capabilities
- Improve efficiency and reduce the shot cycle duration
  - Reduce critical path for each type of shot cycle through process and engineered improvements in areas such as alignment and diagnostic exchanges
  - Eliminate low value process or QC steps using risk-graded approach
- Incentivize users to design campaigns that can be executed most efficiently on NIF
  - Allocate time on facility rather than shots
  - Mini-campaigns with common facility configuration
  - Increase fraction of shots that are room T & low-optics-usage

9 system shots (7 target shots), including two “mini-campaigns” in hydrodynamics (3 shots) and hohlraum physics (4 shots), were conducted the week of Feb. 3, 2014

The next few years will provide exciting opportunities for a broad variety of science at NIF

- Implementation of 120-day study recommendations, planned to start in Q4FY2014, should increase shot rate, benefitting all user communities
  - Mini-campaigns planned in Q2 and Q3 should provide approximately 6 and11 additional shots, respectively, compared to submitted Use Plan
  - Increase in Q4 could be up to 30 shots above Use Plan
- ARC and other advanced laser, diagnostic, and target fabrication capabilities will become available
- NIF is planning to issue a new fundamental science call, incorporating the "day allocation" and "mini-campaign" model, following the NIF Science Technical Review Committee (TRC) meeting on April 8-9, 2014
  - Depends on FY2015 budget ("rollout" planned March 4, 2014)
  - Further details to be discussed at this meeting
- Ignition program is making strong progress and offers opportunity for scientific collaboration

Please join us for the exciting times ahead!